KOLHAN UNIVERSITY, CHAIBASA JHARKHAND



Revised Curriculum and Credit Frame Work For SEM – I As per FYUGP, NEP- 2020 (U.G. Chemistry – 2022 Onward)

University Department of Chemistry Kolhan University, Chaibasa West Singhbhum, Jharkhand-833202

University Department of Chemistry, Kolhan University, Chaibase

Barant Shubbanka

Index

Sem	Code	Papers	Credits (Th +P)
	MJ-1	Major Paper-1 (Inorganic Chemistry)	3 + 1
Ι	MN-1	Minor Paper-1 (Inorganic Chemistry)	3 + 1
	MDC/IRC-1	Multi-Disciplinary/Introductory Regular Course	3 + 0

• For End Semester Examination (ESE 60 marks, 3Hrs Exam):

There will be **two** group of question. **Group A is compulsory** which will **contain** three questions. **Question** No. **1 will be very sort answer type** consisting of five questions of 1 mark each. **Question No. 2 & 3 will be short answer type** of 5 marks. **Group B will contain descriptive type** five question of fifteen marks each, out of which any three are to answer.

• For End Semester Examination (ESE 75 marks, 3Hrs Exam):

There will be **two** groups of questions. **Group A is compulsory** which will contain three questions. **Question No. 1 will be very short answer type** consisting of five questions of 1 mark each. **Question No. 2 & 3 will be short answer type** of 5 marks. **Group B will contain descriptive type** six questions of fifteen marks each, out of which any four are to answer.

Semester-I PAPER Title: Major Paper-1 (MJ-1) Credits - 03

Learning objective:

- Atomic theory and its evolution
- Elements in periodic table; physical and chemical characteristics, periodicity
- Characterize bonding between atoms, molecules, interaction and energetic, hybridization and shapes of atomic, molecular orbital's, bond parameters, bond-distances and energies.

Inorganic Chemistry-1

FM-60 Marks

Content

1 Atomic Structure:

Unit

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de' Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ 2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

2 **Periodicity of Elements:**

s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van'der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (f) Electron gain enthalpy, trends of electron gain enthalpy. (g)Electro negativity, Pauling, Mullikan, Allred Rachow scales, electro negativity and bond order, partial charge, hybridization, group electro negativity. Sanderson electron density ratio.

3 Chemical Bonding:

(i) **Ionic bond:** General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation, expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

(ii) Covalent bond: Lewis structure, Valence Shell Electron Pair Repulsion Theory (VSEPR), Shapes of simple molecules and ions containing lone-and bond-pairs of electrons multiple bonding, sigma and pi-bond approach, Valence Bond theory, (Heitler-London approach). Hybridization containing s, p and s, p, d atomic orbitals, shapes of hybrid orbitals, Bents rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of simple homonuclear and heteronuclear diatomic molecules, MO diagrams of simple tri and tetra-atomic molecules, e.g., N₂, O₂, C₂, B₂, F₂, CO, NO, and their ions; HCl, BeF₂, CO₂, HCHO, (idea of s-p mixing and orbital interaction to be given). Covalent character in ionic compounds, polarizing power and polarizability. Fajan rules, polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Ionic character from dipole moment and electro negativities.

4 Metallic bonding and Weak chemical forces:

Metallic Bond: Qualitative idea of free electron model, Semiconductors, Insulators. Weak Chemical Forces: van 'der Waals, ion-dipole, dipole-dipole, induced dipoledipole interactions, hydrogen bond, effects of hydrogen bonding on melting and boiling points, solubility, dissolution.

20h

05h

Hours

Time 3hrs

Sessional Internal Assessment (SIA) Full Marks – 15 Marks A – Internal written Examination – 10 Marks (1 Hr) B – Over All Performance Including Regularity – 05 Marks

Books Recommended:

- Advanced Inorganic Chemistry by Cotton and Wilkinsons
- Principles of Inorganic Chemistry by Puri, Sharma and Kalia
- Inorganic Chemistry, by Moillers
- Pradeep's Inorganic Chemistry, Vol.- I, II and III
- Dinesh Inorganic Chemistry, Vol.- I, II and III
- Text Book of Inorganic Chemistry by P.L. Soni
- Selected Topics in Inorganic by Satyaprakash, Malik, Madan and Tuli
- Advanced Inorganic Chemistry by Gurdeep and Harish

Semester-I PAPER Title: Chemistry Practical - MJ-1 LAB Credits - 01

FM-25 Marks

Pass Marks - 10

Content

Titrimetric Analysis

(A) Preparation of solutions of different Morality/Normality.

(B) Acid-Base Titrations

- (i) Estimation of carbonate and hydroxide present together in mixture.
- (ii) Estimation of carbonate and bicarbonate present together in a mixture.

(C) Oxidation-Reduction Titration

- (i) Estimation of Fe (II) and oxalic acid using standardized KMnO₄ solution.
- (ii) Estimation of oxalic acid and sodium oxalate in a given mixture.
- (iii) Estimation of Fe (II) with K₂Cr₂O₇ using internal (diphenylamine, anthranilic acid) and external indicator.

(D) Iodometry

(i) Estimation of Cu using standardized solution of Sodium Thiosulphate Solution.

Experiments – 15 Marks Viva-Voice – 05 Marks Notebook – 05 Marks

Semester-I PAPER Title: Minor Paper-1 (MN-1) Credits - 03

Learning objective:

- Atomic theory and its evolution
- Elements in periodic table; physical and chemical characteristics, periodicity
- Characterize bonding between atoms, molecules, interaction and energetic, hybridization and shapes of atomic, molecular orbital's, bond parameters, bond-distances and energies.

Inorganic Chemistry-1

FM-60 MarksTime 3hrsContentHoursAtomic Structure:Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de'12hBroglie equation, Heisenberg's Uncertainty Principle and its significance. Shapes of s, p, d12hand f orbital's. Contour boundary and probability diagrams. Pauli's Exclusion Principle,12hHund's rule of maximum multiplicity, Aufbau principle and its limitations, Variation of
orbital energy with atomic number.12h

2 **Periodicity of Elements:**

Unit

1

s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van'der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (f) Electron gain enthalpy, trends of electron gain enthalpy. (g)Electro negativity, Pauling, Mullikan, Allred Rachow scales, electro negativity and bond order, partial charge, hybridization, group electro negativity. Sanderson electron density ratio.

3 Chemical Bonding:

(i) Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its 21h limitations. Packing of ions in crystals. Born-Landé equation with derivation, expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

(ii) Covalent bond: Lewis structure, Valence Shell Electron Pair Repulsion Theory (VSEPR), Shapes of simple molecules and ions containing lone-and bond-pairs of electrons multiple bonding, sigma and pi-bond approach, Valence Bond theory, (Heitler-London approach). Hybridization containing s, p and s, p, d atomic orbitals, shapes of hybrid orbitals, Bents rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of simple homonuclear and heteronuclear diatomic molecules, MO diagrams of simple tri and tetra-atomic molecules, e.g., N₂, O₂, C₂, B₂, F₂, CO, NO, and their ions; HCl, BeF₂, CO₂, HCHO, (idea of s-p mixing and orbital interaction to be given). Covalent character in ionic compounds, polarizing power and polarizability. Fajan rules, polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Ionic character from dipole moment and electro negativities.

(iii) Metallic bonding: Metallic Bond: Qualitative idea of free electron model, Semiconductors, Insulators.

Sessional Internal Assessment (SIA) Full Marks – 15 Marks A – Internal written Examination – 10 Marks (1 Hr) B – Over All Performance Including Regularity – 05 Marks

Books Recommended:

- Advanced Inorganic Chemistry by Cotton and Wilkinsons
- Principles of Inorganic Chemistry by Puri, Sharma and Kalia
- Inorganic Chemistry, by Moillers
- Pradeep's Inorganic Chemistry, Vol.- I, II and III
- Dinesh Inorganic Chemistry, Vol.- I, II and III
- Text Book of Inorganic Chemistry by P.L. Soni
- Selected Topics in Inorganic by Satyaprakash, Malik, Madan and Tuli
- Advanced Inorganic Chemistry by Gurdeep and Harish

Semester-I PAPER Title: Chemistry Practical - MN-1 LAB Credits - 01

FM-25 Marks

Content

Pass Marks - 10

Titrimetric Analysis

(A) Preparation of solutions of different Morality/Normality.

- (B) Acid-Base Titrations
 - (i) Estimation of carbonate and hydroxide present together in mixture.
 - (ii) Estimation of carbonate and bicarbonate present together in a mixture.

(C) Oxidation-Reduction Titration

- (i) Estimation of Fe (II) and oxalic acid using standardized KMnO4 solution.
- (ii) Estimation of oxalic acid and sodium oxalate in a given mixture.

(iii) Estimation of Fe (II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

Experiments – 15 Marks Viva-Voice – 05 Marks Notebook – 05 Marks

Semester-II PAPER Title: Major Paper -2 (MJ-2) Credits - 03

Learning objective:

- Basic of organic molecules, structure, bonding, reactivity and reaction mechanisms.
- Stereochemistry of organic molecules.
- Aromatic compounds and Aromaticity, mechanism of aromatic reactions
- Electrophilic, Nucleophilic, free radicals, electro negativity, resonance, and intermediates along the reaction pathways.

Organic Chemistry - 1

Content

Time 3hrs

Unit 1

FM-60 Marks

Basics of Organic Chemistry:

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electrometric, resonance and mesmeric effects, hyper conjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophilic and Nucleophilic; Nucleophilicity and basicity; Types, shape and relative stabilities of reaction intermediates (Carbocations, Carbanions, Free radicals and Carbenes). Organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

2 Isomerism: Structural & Stereoisomer

Concept of asymmetry, Fischer Projection, Newman and Sawhorse projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centers, Di stereoisomers, meso structures, Racemic mixtures, Relative and absolute configuration.

3 Chemistry of Aliphatic Hydrocarbons Alkanes and Cycloalkanes

Formation of Alkanes, Wurtz Reaction, Wurtz- Fittig Reactions, Free radical substitutions: Halogenations - relative reactivity and selectivity.

Cycloalkanes and Conformational Analysis

Cycloalkanes and stability, Baeyer strain theory, Conformation analysis, Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms.

Alkene, Diene and Alkynes

Formation of alkenes and alkynes by elimination reactions, Mechanism of E_1 , E_2 , E_1 cb reactions. Saytzeff and Hofmann eliminations. Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff's &Anti Markownikoff's addition), mechanism of oxymercuration demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2- and 1, 4- addition reactions in conjugated Dienes and, Diels- Alder reaction; Allylic and benzylic bromination and mechanism, e.g., propene, 1-butene, toluene, ethyl benzene. Reactions of alkynes: Acidity, Electrophilic additions.

4 Arenes and Aromaticity

Aromaticity: Huckel's rule, aromatic character of arenes, cyclic Carbocations/carbanions and heterocyclic compounds with suitable examples. Nomenclature of benzene derivatives. The aryl group Aromatic nucleus and side chain. Electrophilic aromatic substitution: halogenations, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of substituent groups. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure. MO picture.

10h

15h

10h

Hours

Sessional Internal Assessment (SIA) Full Marks – 15 Marks

A – Internal written Examination – 10 Marks (1 Hr)

B – Over All Performance including Regularity – 05 Marks

Books Recommended:

- Advanced Organic Chemistry by Bahl and Bahl
 - Pradeep's Organic Chemistry by Pradeep Publication
 - Dinesh Organic Chemistry
 - Text Book of Organic Chemistry, Vol.- I and II by I.L. Finar
 - Text Book of Organic Chemistry, Vol.- I and II by P.L. Soni
 - Reactions and Reagents by O.P. Agarwal
 - Reactions and Reagents by Gurdeep Raj Chatwal.
 - Organic Chemistry by Morrison and Boyd

Semester-II PAPER Title: Major Paper-3 (MJ-3) Credits - 03

Learning objective:

- Familiarization with various states of matter
- Understanding Kinetic model of gas and its properties
 - Ionic equilibria electrolyte, ionization, dissociation

Physical Chemistry - 1

FM- 60 Marks

Unit

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Content

1 Gaseous state

Behavior of real gases: Deviations from ideal gas behavior, compressibility factor, and its variation with pressure for different gases. Causes of deviation from ideal behavior. Van der Waals equation of state, its derivation and application in explaining real gas behavior, Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, critical and van der Waals constants, law of corresponding states.

2 Kinetic molecular model of a gas:

postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η ; variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy.

3 Liquid state:

Structure and physical properties of liquids; vapor pressure, surface tension, viscosity, and their dependence on temperature, Effect of addition of various solutes on surface tension, cleansing action of detergents. Structure of water.

4 Ionic equilibria:

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di- and tri-protic acids. Salt hydrolysis, hydrolysis constants, degree of hydrolysis and pH for different salts. Buffer solutions; Henderson equation, buffer capacity, buffer range, buffer action, applications of buffers in analytical chemistry, Solubility and solubility product. Bronsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, leveling solvents, Lewis's acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of indicators; selection of indicators; and their limitations. Multistage equilibria in polyelectrolytes.

5 Solid state:

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, Various types of defects in crystals, Glasses and liquid crystals.

Sessional Internal Assessment (SIA) Full Marks – 15 Marks

A – Internal written Examination – 10 Marks (1 Hr.)

B – Over All Performance including Regularity – 05 Marks

Hours 10h

Time 3hrs

10h

05h

10h

Books Recommended:

- 1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
- 2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
- 3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
- 4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
- 5 G. M. Barrow, Tata McGraw Hill (Fifth Edition) (2007)

6 Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

7 Roy, B. N. Fundamentals of Classical and Statistical Thermodynamics Wiley, 2001

Semester-II PAPER Title: Chemistry Practical - MJ-2 LAB Credits - 02

FM-50 Marks

Pass Marks – 20 Time: 03 hrs

Content

1. Detection of element [N, S, P and halogens] and detection of functional group in organic compounds containing one functional group including monosaccharides. COOH, Phenolic – OH, Aldehydic, Ketonic, Nitro, Amino and amides.

2. Surface tension measurements.

a. Determine the surface tension by (i) drop number (ii) drop weight method.

b. Study the variation of surface tension of detergent solutions with concentration.

3. Viscosity measurements using Ostwald's viscometer.

a. Determination of viscosity of aqueous solutions of

- (i) polymer
- (ii) ethanol and
- (iii) sugar at room temperature.
- b. Viscosity of sucrose solution with the concentration of solute.

• pH metry

- a. Effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
- b. Preparation of buffer solutions of different pH
 - I. Sodium acetate-acetic acid
 - ii. Ammonium chloride-ammonium hydroxide
- c. pH metric titration of
 - (I) strong acid vs. strong base,
 - (ii) Weak acid vs. strong base.
- d. Determination of dissociation constant of a weak acid.

One Experiment – 30 Marks Viva-Voice – 10 Marks Notebook & Regularity – 10 Marks

Semester-II PAPER Title: Minor Paper-2A (MN-2A) Credits - 03

Learning objective:

- To understand the importance of science in everyday life. •
- To understand the preparation of soaps and detergents. •
- To know about kinds of Biofuel and its uses. •
- To know about uses Fibers in day-to-day life. •

Chemistry in Everyday Life

Time 3hrs FM-60 Marks Content Hours 1 **Respiration and energy production in human body:** 10h Brief outline of haemoglobin and myoglobin, oxygen transport mechanism in body, co-

operativity. Energy production in body, ATP; enzyme responsible for food digestion, mechanism of food digestion, active site of cytochrome c-oxidase.

2 Vitamins and minerals:

Need for vitamin in body, types of vitamins, water soluble and fat-soluble vitamins, Vitamin B-12, vitamin C (Cyanocobalamine), D. Vitamin K. Role of minerals in body, iodine deficiency and remedy.

3 Significance of Radical chemistry in living system:

Radical production in environment, superoxide and peroxide, health impact, action of radicals, cell mutation, diseases caused by free radical, cancer, radical quencher, antioxidants, natural anti-oxidants like vegetables, beverages like tea and coffee, fruits. Radical destroying enzymes: superoxide dismutase, catalase, peroxidase, mechanism of action.

4 **Chemistry of Materials:**

Soaps and Detergents - their action, Biofuels - production of biofuels and its utility as alternative fuel source, Fibers: natural fibres, cotton, wool, silk, rayon, artificial fibres, polyamides, acrylic acid, PVC, PVA; Examples of natural biodegradable polymers, cellulose, cellulose acetate, cellophane, soy protein, corn, zein protein, wheat gluten protein, synthetic biodegradable polymers. Use of polymeric materials in daily life.

Sessional Internal Assessment (SIA) Full Marks – 15 Marks A – Internal written Examination – 10 Marks (1 Hr) **B** – Over All Performance including Regularity – 05 Marks **Books Recommended:**

1. Kaim W, Bioinorganic Chemistry, Vol 4, Brigitte Scwederski, Wiley, 1994.

2. Crichton R. H. Biological Inorganic Chemistry – An Introduction, Elsevier, 2008.

3. Berg J. M., Tymoczeko J. L., Stryer I. Biochemistry, W. H. Freeman, 2008.

4. Bertini, I., Gray, H. B., Lippard, S. J. and Valentine, J. S. (1994) Bioinorganic Chemistry. University Science Books (1994)

5. Lippard S., Berg J. M. Principles of Bioinorganic Chemistry; University Science Books 1994.

6. Polymer science, V. R. Gowariker, N. V.Viswanathan, J. Sreedhar, New Age International.

Unit

10h

10h

Semester-II PAPER Title: Chemistry Practical - MN-2A LAB Credits - 01

FM-25 Marks

Pass Marks - 10

Content

- Analysis of soaps and detergents. •
- Analysis of Biofuels flash point, pour point, cloud point. •
- Preparation of Nylon6/6,6
- Testing of adulterant in food, oil and vegetable
- Vitamin-C preparation. •

Experiments – 15 Marks Viva-Voice – 05 Marks

- 05 Marks Notebook

KOLHAN UNIVERSITY, CHAIBASA JHARKHAND



Revised Curriculum and Credit Frame Work As Per FYUGP, NEP-2020 For UG Chemistry (w.e.f. 2022)

University Department of Chemistry Kolhan University, Chaibasa West Singhbhum, Jharkhand- 833202

Kolhan University Department of Chemistry Semester wise course code & credit point as per FYUGP NEP – 2020

Sem	Code	Index	Credits (Th +P)
	ML	· Papers	3+0
	MI-1 Prostinal	Major Paper-1 (Inorganic Chemistry 17	0+1
I	MN-1A	Miner Paper I & (Joorganic Chemistry)	3+0
	MN-1A Prostinal	Practical of MN-1A	0+1
	MDC/IRC I	Multi Dissiplinary/Introductory Regular Course	3+0
	MI-2	Major Paper -2 (Organic Chemistry - 1)	3+0
	MJ-3	Major Paper -3 (Physical Chemistry - 1)	3 + 0
n	MJ-2 Practical	Practical of MJ-2 & MJ-3	0+2
	MN-2A	Minor Paper - 2A (Chemistry in Everyday Life)	3 + 0
	MN-2A Practical	Practical of MN-2A	0+1
	MJ-4	Major Paper - 4 (Inorganic Chemistry - 2)	3+0
	MJ-5	Major Paper -5 (Organic Chemistry - 2)	3 + 0
ш	MJ-3 Practical	Practical MJ-4 & MJ-5	0+2
	MN-1B	Minor Paper – 1B (Physical Chemistry)	3+0
	MN-1B Practical	Practical of MN-1B	0 + 1
_	MI-6	Major Paper-6 (Inorganic Chemistry - 3)	3+0
ł	MJ-7	Major Paper -7 (Organic Chemistry - 3)	3+0
ł	MI-8	Major Paper -8 (Physical Chemistry - 2)	3+0
IV	MI-4 Practical	Practical of MI-6 MI-7 & MI-8	0+3
ł	MN-2B	Minor Paper -2B (Analytical Chemistry)	3+0
ł	MN-2B Practical	Practical of MN-2B	0+1
	MI-9	Major Paper - 9 (Inorganic Chemistry - 4)	3+0
ł	MI-10	Major Paper - 10 (Molecular Spectroscopy)	3+0
H	MI-11	Major Paper - 11 (Physical Chemistry - 3)	3+0
v	MLS Practical	Practical of MJ-9, MJ-10 & MJ-11	0+3
ŀ	MN-1C	Minor Paper 1C (Organic Chemistry)	3+0
h	MN-1C Practical	Practical of MN-1C	0+1
	ML-12	Major Paper -12 (Analytical Chemistry)	3+0
ŀ	ML-13	Major Paper -13 (Green Chemistry)	3+0
ŀ	MI-14	Major Paper -14 (Heterocyclic Chemistry)	3+0
,	ML15	Major Paper -15 (Biochemistry)	3+0
″ -	MI 6 Brastical	Practical of ML12 ML13 ML14 & ML15	0+4
H	MJ-0 Flactical	Minor Paper - 2C (Bio Ingrania Chamistra)	0+4
-	MN-20	Prostical of MOL 2C	3+0
	MN-2C Practical	Main Days 16 (Environmental Charlins)	0+1
F	MJ-16	Major Paper -10 (Environmental Chemistry)	3+0
L	MJ-17	Major Paper -17 (Organic Chemistry – 4)	3+0
L	MJ-18	Major Paper -18 (Group Theory & Bioinorganic Chemistry)	3+0
ո ի	MJ-19	Major Paper-19 (Physical Chemistry - 4)	3+0
L	MJ-7 Practical	Practical of MJ-16, MJ-17, MJ-18 & MJ-19	0+4
L	MN-ID	Minor Paper – ID (Biochemistry)	3 + 0
	MN-1D Practical	Practical of MN-1D	0+1

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	MJ-20	Main Dense 20 (Application of Spectroscopy)	3 + 0
	AMI-1	Advanced Major Paper-1 (Medicinal Chemistry)	3+0
	AMI-2	Advanced Major Paper-2 (Polymer Chemistry)	3 + 0
VIII	AMI-3	Advanced Major Paper-3 (Material Chemistry)	3 + 0
	MJ-8 + AMJ-1 Practical	Practical of MJ-20, AMJ-1, AMJ-2 & AMJ-3	0 + 4
	MN-2D	Minor Paper - 2D (Bio-Organic Chemistry)	3 + 0
	MN-2D Practical	Practical of MN-2D	0 + 1

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Semester-III PAPER Title: Major Paper-4 (MJ-4) Credits - 03

Learning objective:

- Oxidation-Reductions and their use in metallurgy.
- Chemistry of s and p-block elements.
- Inorganic polymers and their use.
- · Chemistry of noble gases and their compounds; application of VSEPR theory in explaining structure and bonding.

Inorganic Chemistry - 2

Time 3hrs

Content

Unit 1

Oxidation-Reduction and general principle of metallurgy: Redox equations, Standard Electrode Potential and its application to inorganic reactions. Occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon or carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel- de Boer process and Mond's process, Zone refining.

Noble Gases: 2

FM-60

Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF2, XeF4 and XeF6; Bonding in noble gas compounds (Valence bond and MO treatment for XeF2), Shapes of noble gas compounds (VSEPR theory).

Chemistry of s and p Block Elements: 3

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behavior of first member of each group. Allotropy and catenation. Complex formation tendency of s and p block elements. Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate. Structure, bonding, preparation, properties and uses. Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes,

Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Per-oxo acids of Sulphur inter-halogen compounds, polyhalide ions, pseudo-halogens, properties of halogens.

Inorganic Polymers: 4

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.

Sessional Internal Assessment (SIA) Full Marks - 15 Marks A - Internal written Examination - 10 Marks (1 Hr.) B - Over All Performance including Regularity - 05 Marks

Books Recommended:

- Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991. (i)
- Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. Concepts & Models of Inorganic Chemistry 3rd (ii) Ed., John Wiley Sons, N.Y. 1994.
- Greenwood, N.N., Earnshaw. Chemistry of the Elements, Butterworth-Heinemann. 1997. (iii)
- Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH, 1999. (iv)
- Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002. (v)
- Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry Fourth Ed., Pearson, 2010. (vi)
- Atkins, P. W and Shriver D. N. Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010). (vii)

15h

08h

10h

Hours 12h

Semester-III PAPER Title: Major Paper-5 (MJ-5) Credits - 03

Learning objective:

Unit

- Basic uses of reaction mechanisms.
- Name reactions, uses of various reagents and the mechanism of their action.
- Organometallic compounds and their uses
- · Use of reagents in various organic transformation reactions

Organic Chemistry - 2

FM-60

Content

1 **Chemistry of Halogenated Hydrocarbons:**

Alkyl halides: Methods of preparation, Nucleophilic substitution reactions - SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; Nucleophilic substitution vs. elimination.

Aryl halides: Preparation, including preparation from diazonium salts. Nucleophilic aromatic substitution; SNAr, Benzyne mechanism.

Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards Nucleophilic substitution reactions.

Organometallic compounds of Mg and Li and their use in synthesis.

2 Alcohols, Phenols, Ethers and Epoxides:

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Preparation and properties of glycols: Oxidation by periodic acid and lead tetra acetate, Pinacol-Pinacolone rearrangement.

Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer-Tiemann and Kolbe's-Schmidt Reactions, Fries and Claisen rearrangements with mechanism.

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxies with alcohols, ammonia derivatives and LiAlH4

3 **Carbonyl Compounds:**

Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic additionelimination reactions with ammonia derivatives; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, a-substitution reactions, oxidations and reductions (Clemmensen, Wolff- Kishner, LiAIH4, NaBH4, MPV, PDC and PGC); Addition reactions of unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-enoltautomerism.

4 **Carboxylic Acids and their Derivatives:**

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids; Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Hofmann bromamide degradation Reformatsky reactions. and Curtius rearrangement.

5 Sulphur containing compounds:

Preparation and reactions of thiols, thioethers and sulphonic acids,

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10h

12h

10h

10h

03h

Time 3hrs Hours

Sessional Internal Assessment (SIA) Full Marks – 15 Marks A – Internal written Examination – 10 Marks (1 Hr.) B - Over All Performance including Regularity - 05 Marks

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Books Recommended:

- (i)
- Solomons, T.W G., Fryhle, B. Craig. Organic Chemistry, John Wiley & Sons, Inc (2009). (ii)
- McMurry, J.E. Fundamentals of Organic Chemistry, Seventh edition Cengage Learning, 2013. (iii)
- P Sykes, A Guide Book to Mechanism in Organic Chemistry, 6th Edition (1997), Orient Longman, (iv)
- Morrison R. T. and Boyd R. N. Organic Chemistry, Sixth Edition Prentice Hall India, 2003. (v) Ahluwalia,
- V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparationand Quantitative Analysis, University Press (2000). (vi)
- Kalsi, P. S. Organic reacations and their mechanisms, New Age Science (2010).
- (vii) Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press Inc., New York (2001).

Semester-III PAPER Title: Chemistry Practical - MJ-3 LAB Credits- 02

FM - 50

Pass Marks- 20

Content

(A) Iodo / Iodimetry Titrations

(i) Estimation of Cu (II) using sodium thiosulphate solution.

(ii) Estimation of Arsenite and Antimony Iodimetrically

(iii) Estimation of available chlorine in bleaching powder iodometrically.

(B) Inorganic preparations

(i) Cuprous Chloride, Cu₂Cl₂

(ii) Preparation of Aluminum potassium sulphat (Potash alum) or Chrome alum.

(iii) Preparation of Sodium Nitroprusside.

(C) Organic preparations

Acetylation

(i) Preparation of Acetanilide from aniline

(ii) Preparation of Aspirin from salicylic acid

Benzoylation

(i) Preparation of Benzanilide from aniline

(ii) Preparation of Benzoyl p - toluidine

Nitration

(i) Preparation of m-dinitrobenzene

(ii) Preparation of picric acid from Phenol

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Experiments – 30 Marks Viva-Voice – 10 Marks Notebook – 10 Marks

Semester-III Course Title: Minor Paper-1B (MN-1B) Credits -03

Learning objective:

FM-60

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- Familiarization with various states of matter
- Understanding Kinetic model of gas and its properties Ionic equilibria - electrolyte, ionization, dissociation

Physical Chemistry

Uni	Time- 3hrs	
t	Content	Hour
1	Chemical kinetics:	S
	Rate of reaction, order and Molecularity of reaction. First and second order reaction. Determination of order of reaction effect of temperature on reaction rate. Activation energy.	05h
	Characteristics of optimize the contraction of the	
	catalysis, autocatalysis, types of catalysis, enzyme catalyst. Theory of	
2	Thermodynamics-I:	0.84
	System & surrounding, types of system, heat, work and internal energy. First law of Thermodynamics, Enthalpy, Heat Capacities, Relation between Cp and Cv. Calculation of W O E and H is inclusional and its internal and its inter	von
3	Thermodynamics-II:	086
	Second law of thermodynamics. Commission of the international	0811
	and camot cycle. Entropy, entropy changes in reversible and irreversible processes Entropy of expansion of ideal gases. Entropy of mixing of gases.	
4	Colloidal chemistry	04h
	Classification, preparation, purification and properties of colloidal solution. Peptization of colloids. Protection of colloids. Origin of charge on colloids. Electrophoresis, coagulation, dialysis, Brownian movement Gold number	
5	Electrochemistry	10h
	Specific, Equivalent and molecular conductivities. Effect of dilution on different types of conductivities. Experimental determination of conductivities. Conductivity cell and cell constant. Ionic mobilities, Kohlrausch's law, Transference number. Arrhenius theory of electrolytes. Dissociation of weak and strong electrolytes.	
6	Gaseous State:	10h
	Kinetic theory of gases Postulates, Kinetic gas equation, Deduction of gas laws from kinetic gas equation, R.M.S. Velocity, Aver-age velocity and Kinetic Energy of Gas molecules, Deviations from ideal behaviour. Vender Waal's equation of state.	

Liquid State:

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals : difference between liquid crystal, solid and liquid. Classification, structures of nematic, smectic and cholesteric phases. Thermography and seven segment cell.

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Sessional Internal Assessment (SIA) Full Marks - 15 Marks A - Internal written Examination - 10 Marks (1 Hr.) B - Over All Performance including Regularity - 05 Marks

Books Recommended:

- Pradeep's Physical Chemistry, Vol.-1, II and III
- · Dinesh Physical Chemistry, Vol.-I, II and III
- Text Book of Physical Chemistry by Puri Sharma and Pathania
- Advanced Physical Chemistry by D.N. Bajpai
- UGC Advanced Physical Chemistry by J.N. Gurtu and A. Gurtu, Vol.-I, II and III

Semester-III Course Title: Chemistry Practical - MN-1B LAB Credits-01

FM - 25

Content

Pass Marks-10

Determination of surface tension of liquids using Stalagmometer. Determination of co-efficient of viscosity liquids using Ostwald's viscometer. Determination of Heat of solution. Determination of Heat neutralization of strong acid and strong base.

Determination of Partition co-efficient of solute between two immiscible liquids. e.g., lodine between carbon tetrachloride and water.

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Experiments - 15 Marks Viva-Voice - 05 Marks Notebook - 05 Marks

Semester-IV PAPER Title: Major Paper- 6 (MJ-6) Credits -03

Learning objective:

Unit

1

- Coordination compounds its nomenclature, theories, d-orbital splitting in complexes, chelate.
- Transition metals, its stability. color, oxidation states and complexes.
- Bioinorganic chemistry metal ions in biological system, its toxicity; hemoglobin.

Inorganic Chemistry -3

FM-60	Content	
Coordination Chemistry:		

Werner's theory, EAN rule, valence bond theory (inner and outer orbital complexes), Crystal field theory, d-orbital splitting, , weak and strong fields, pairing energies, factors affecting the magnitude of (Δ). Octahedral vs. tetrahedral coordination, square planar complexes, d orbital splitting in trigonal bipyramidal, square pyramidal and cubic Ligand field environments, CFSE, Qualitative aspect of Ligand field theory, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with the coordination number 4 and 6, Chelate effect.

2 **Transition Elements:**

General group trends with special reference to electronic configuration, color, variable valency, magnetic and catalytic properties, and ability to form complexes. Difference between the first, second and third transition series. Chemistry of Ti, V, Cr, Mn, Fe and Co in various oxidation states (excluding their metallurgy).

Lanthanides and Actinides: 3

Electronic configuration, oxidation states, color, spectra and magnetic behavior, lanthanide contraction, separation of lanthanides (ion-exchange method only).

Bioinorganic Chemistry: 4 Metal ions present in biological systems, Sodium / K-pump, Toxicity of metal ions (Hg, Pb, Cd and As), chelating agents in medicine. Iron and its application in biosystems, Hemoglobin.

Sessional Internal Assessment (SIA) Full Marks - 15 Marks A - Internal written Examination - 10 Marks (1 Hr.) B - Over All Performance including Regularity - 05 Marks

Books Recommended:

- Purcell, K.F &Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.
- Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.

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- · Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
- · Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry Wiley-VCH, 1999
- · Basolo, F, and Pearson, R.C. Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
- · Greenwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth-Heinemann, 1997.

10h

10h

10h

Hours 15h

Time- 3hrs

Semester-IV PAPER Title: Major Paper- 7 (MJ-7) Credits - 03

Learning objective:

- Nitrogen containing functional groups and their reactions.
- · Familiarization with Polynuclear hydrocarbons and their reactions.
- Alkaloids and Terpenes

Organic Chemistry - 3

FM-60

Unit

Content

1 Nitrogen Containing Functional Groups

Preparation and important reactions of nitro and compounds, nitriles and isonitriles Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3°. Diazonium salts: Preparation and synthetic applications.

2 Heterocyclic Compounds:

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer indole synthesis and Madelung synthesis). Structure elucidation of quinoline and isoquinoline, Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction Derivatives of furan: Furfural and furoic acid.

3 Polynuclear Hydrocarbons:

Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.

4 Alkaloids

Natural occurrence, General structural features, Isolation and their physiological action, Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Resergine.

5 Terpenside Occurrence, classification, isoprene rule. Elucidation of stucture and 05h synthesis of Citral, Neral and α-terpineol.

Sessional Internal Assessment (SIA) Full Marks - 15 Marks

A - Internal written Examination - 10 Marks (1 Hr.)

B - Over All Performance including Regularity - 05 Marks

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15h

Hours

10h

Time 3hrs

10h

Books Recommended:

- (i) Morrison, R. T., Boyd, R. N., Bhatterjee, S.K., Organic Chemistry, 7th Edn., Pearson.
- Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Welly& Sons (1976).

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- (iii) Solomons, T.W., Fryhle Craig, Organic Chemistry, John Wiley & Sons, Inc (2009).
- (iv) McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- (v) Kalsi, P. S. Organic reacations and their mechanisms, New Age Science (2010).

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- (vi) Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press Inc., New York (2001).
- (vii) Singh, J.; Ali, S.M. & Singh, J. Natural Product Chemistry, PrajatiParakashan (2010).
- (viii) Bansal R. K. Heterocyclic Chemistry: Syntheses, Reactions and Mechanisms, New Age, Third Edition (1999).
- (ix) Clayden J., Greeves N., Warren S., Organic Chemistry, (2nd Ed)., (2012), Oxford University Press.

Semester-IV PAPER Title: Major Paper-8 (MJ-8) Credits- 03

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Learning objective:

- Understanding the application of thermodynamics: Joule Thompson effects, partial molar quantities.
- Understanding the concept of heat of reactions and use of equations in calculations of bond energy, enthalpy, etc.
- Dilute solution and its properties.

Physical Chemistry - 2

FM-60 Time 3h		
Unit	Content	Hours
1	Introduction to thermodynamics: Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.	ION
	First law of thermodynamics: Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.	05h
2	Thermo chemistry: Heats of reactions: standard states; enthalpy of formation and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermo chemical data, effect of temperature (Kinche field equations) pressure on enthalpy of reactions.	
3	Second Law of thermodynamics: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics. Calculation of entropy change for reversible and	05h
	irreversible processes.	03h
4	Third law of thermodynamics: Third Law of thermodynamics, calculation of absolute entropy of molecules.	08h
5	Free Energy Functions: Gibbs and Helmholtz energy: variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation;	
	Maxwell relations; thermodynamic equation of state.	05h
6	Partial molar quantities: Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs- Duhem equation, chemical potential of ideal mixtures, change	
23	in thermodynamic functions in mixing of ideal gases.	09h
7	Dilute solutions: Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Thermodynamic derivation using chemical potential to derive relations between the four Colligative properties: [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal dissociated and associated solutes in solution.	

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Sessional Internal Assessment (SIA) Full Marks – 15 Marks A – Internal written Examination – 10 Marks (1 Hr.) B – Over All Performance including Regularity – 05 Marks

Books Recommended:

- (i) Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
- (ii) Ball, D. W. Physical Chemistry Thomson Press, India (2007).

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- (iii) Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
- (iv) Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
- (v) G. M. Barrow, Tata McGraw Hill (Fifth Edition) (2007).
- (vi) Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
- (vii) Levine, I.N. Physical Chemistry 6th Ed., Tata McGraw Hill, 2010.
- (viii) Metz, C.R. 2000 solved problems in chemistry, Schaum Series, 2006.
- (ix) Khosla, B. D.; Garg, V. C. and Gulati, A. Senior Practical Physical Chemistry, R. Chand New Delhi, 2011.

Semester-IV PAPER Title: Chemistry Practical - MJ-4 LAB Credits- 03

FM - 75

Pass Marks- 30

Content

(A) INORGANIC

- Gravimetric estimation of Ag⁺, Ba²⁺, Ni²⁺, Cu²⁺, Cl⁻, SO₄²⁻.
- Synthesis of ammine complexes of Ni (11) and its Ligand exchange reactions (e.g. bidentate Ligand like acetyl acetone, DMG, glycine) by substitution method.

(B) PHYSICAL

- 1. Study the kinetics of the following reactions.
- a. Acid hydrolysis of methyl acetate with hydrochloric acid.

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- b. Saponification of ethyl acetate.
- 2. To find the partion Coefficient of Solution Between the two Immiscible Liquid
- a. Carbon Tetrachloride and water

b. Benzoic acid and water

(C) ORGANIC

1. Qualitative analysis of unknown organic compounds containing monofunctional groups.

- 2. Preparation of methyl orange.
- 3. Extraction of caffeine from tea leaves.

1.

Experiments – 45 Marks Viva-Voice – 15 Marks Notebook – 15 Marks

Semester-IV PAPER Title: Minor Paper-2B (MN-2B) Credits - 03

Learning objective:

- Expresses the role of analytical chemistry in science.
- Compare qualitative and quantitative analyses.
- Expresses the quantitative analysis methods.
- Expresses the qualitative analysis methods.

Analytical Chemistry

FM-60 Marks

Content

Unit

1

- Qualitative analysis of Inorganic salts: Principle involved in the separation of cations. Application of solubility product and common ion effect. Detection and removal interfering radicals (eg. PO₃⁻, BO₃⁻).Special tests for the mixture of acid radicals – Carbonate in presence of sulphite, Nitrate in presence of Nitrite. Nitrate in presence of bromide and iodide. Chloride, Bromide and Iodide in presence of each other. 07h
- 2 Principles involved in volumetric analysis Acidimetry and alkalimetry. Principles involved in the red-ox titrations: uses of KMnO4 and K2Cr2O7, lodometry and odimetry.
- Detection of elements and functional groups in the organic compounds. Elements: N, P, S and halogens.
 Functional groups: Hydroxyd, -OH (alcoholic), Nitro, -NO₂, Amide - CONH₂, Ketonic=C=O, Aldehydic - CHO, Carboxylic - COOH, Phenolic - OH Amino - NH₂
- 4 Spectroscopy: Ultraviolet and visible spectra (electronic spectra). Uses of UV and visible spectra. Infra-red (IR), Nuclear magnetic resonance (NMR) uses of IR and NMR spectra.
- 5 Organic reagents in inorganic analysis:
 (i) Dimethyl glyoxime (ii) α Furil dioxime (ii) 8-hydroxy quinoline (iy) α nitroso
 β-naphthol (y) Cupron (yi) Cupferron (vi) αα Dipyridyl(vii) Salicylaldoxime
 (xi) Nitron (xii) Dithiazone

Sessional Internal Assessment (SIA) Full Marks – 15 Marks A – Internal written Examination – 10 Marks (1 Hr) B – Over All Performance including Regularity – 05 Marks

Books Recommended:

- 1. General Chemistry by Sanyal & Sanyal
- 2. General Chemistry by F. M. Miller
- 3. Industrial Chemistry by B.K. Sharma
- 4. Inorganic Practical Chemistry by P.K. Banerjee

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5. Organic Practical Chemistry by Banerjee & Mukhopadhaya

Hours

Time 3hrs

3

08h

10h

Semester-IV PAPER Title: Chemistry Practical - MN-2B LAB Credits - 01

FM-25 Marks

Pass Marks - 10

Content

• Gravimetric estimation of Ag⁴, Ba²⁺, Cl^{*} and SO4^{2^{*}}

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- · Preparation of potash alum.
- Preparation of chrome alum.

Experiments - 15 Marks

Viva-Voice – 05 Marks

Notebook - 05 Marks